JOURNAL OF THEORETICAL BIOLOGY

Chief Editor: J. F. DANIELLI
Associate Editor: L. WOLPERT
Editorial Board:
S. ARNOTT
E. A. BARNARD
J. BONNER
H. BREMERMANN
M. CALVIN
J. D. COWAN
N. GOEL
B. GOODWIN
S. KAUFFMAN
R. B. LUFTIG
H. M. MARTINEZ
R. M. MAY
J. MAYNARD SMITH
J. D. MURRAY
R. REIN
R. ROSEN
M. VOLKENSTEIN
A. WINFREE
M. YČAS
J. Z. YOUNG

VOLUME 77

March to April 1979

ACADEMIC PRESS

London New York San Francisco

QH301
J75

Copyright © 1979, by Academic Press Inc. (London) Ltd

ALL RIGHTS RESERVED

No part of this volume may be reproduced in any form, by photostat, microfilm, or any other means, without written permission from the publishers.

Printed in Great Britain

Contents of Volume 77

Number 1, 7 March 1979

ANDERSSON, G., Self-electrophoresis of Membrane Molecules and Chromosomes: Unifying Hypothesis of Cell Cycle Controls . 1

STAUFFER, H. B., A Generalization of Pileou's Index of Non-randomness 19

AINSWORTH, S., The Exponential Model for a Regulatory Enzyme: its Extension to Describe Catastrophic Changes in Function . . 27

DROMASHKO, S. E. and TROITSKY, N. A., A Stochastic Model of Recombination during Conjugation in *Escherichia coli* K-12 . . 37

SCHEIE, P. O., Forces Causing Osmotic Pressure 47

ROTENBERG, M., Stability Analysis of the Two Compartment Model of Cell Proliferation 51

TUCKWELL, H. C., Synaptic Transmission in a Model for Stochastic Neural Activity 65

MCGAVIN, S., A Reconsideration of the Possibility of the Specific Pairing of Base Pairs 83

YORKE, E. D., A Possible Magnetic Transducer in Birds . . . 101

HANIG, J. P. and LAMANNA, C., Toxicity of Botulinum Toxin: A Stoichiometric Model for the Locus of its Extraordinary Potency and Persistence at the Neuromuscular Junction . . . 107

IMAI, Y., MORI, H., MURAKAMI, M. and YOSHIDA, H., Flow Analysis in a Biological System Adopting the Buffer Capacitor Concept . 115

KIKUCHI, O., HOPFINGER, A. J. and KLOPMAN, G., A New Type of Semi-empirical Molecular Orbital Method for Large Molecules . 129

WHITE, A. and THAMES, H. D., Jr., State Vector Models of the Cell Cycle II: The First Three Moments of the Transit Time Distribution . 141

AMIDON, G. L., PEARLMAN, R. S. and ANIK, S. T., The Solvent Contribution to the Free Energy of Protein-Ligand Interactions . . 161

Number 2, 21 March 1979

COMINS, H. N., Analytic Methods for the Management of Pesticide Resistance 171

WIEGEL, F. W., Hydrodynamics of a Permeable Patch in the Fluid Membrane 189

HOLDER, N., Positional Information and Pattern Formation in Plant Morphogenesis and a Mechanism for the Involvement of Plant Hormones 195

LERNER, M. R., Immortal Fibroblasts? 213

IDSO, S. B., PINTER, P. J., JR., HATFIELD, J. L., JACKSON, R. D. and REGINATO, R. J., A Remote Sensing Model for the Prediction of Wheat Yields Prior to Harvest 217

LETTERS TO THE EDITOR

LUCHNIK, A. N., On the Mechanism of SOS-Repair and Prophage Induction: Relaxation Hypothesis 229

MALCOLM, A. D. B., Amino Acid Sequence Homology . . 233

Number 3, 7 April 1979

LINKENS, D. A., Modulation Analysis of Forced Non-linear Oscillators for Biological Modelling. 235

GOEL, N. S. and YČAS, M., On the Computation of the Tertiary Structure of Globular Proteins II 253

GINZBURG, L. R. and COSTANTINO, R. F., On the Rate of Genetic Adaptation Under Natural Selection 307

BRITTON, N. F. and MURRAY, J. D., Threshold, Wave and Cell-cell Avalanche Behaviour in a Class of Substrate Inhibition Oscillators 317

KIBBY, M. R., The Matrix Representation of Pharmacokinetic Models. 333

WICKEN, J. S., The Generation of Complexity in Evolution: A Thermodynamic and Information-Theoretical Discussion . . . 349

ONDA, H., A New Hypothesis on Mitotic Control Mechanism in Eukaryotic Cells: Cell-Specific Mitosis-Inhibiting Protein Excretion Hypothesis 367

LETTERS TO THE EDITOR

JOHNSON, L. L., Kin Selection in Finite Sibships . . . 379

ROSEN, R., A Comment on Surface Modulating Assemblies . 383

Number 4, 21 April 1979

SAVAGEAU, M. A., Feedforward Inhibition in Biosynthetic Pathways: Inhibition of the Aminoacyl-tRNA Synthetase by the Penultimate Product 385

SAVAGEAU, M. A. and JACKNOW, G., Feedforward Inhibition in Biosynthetic Pathways: Inhibition of the Aminoacyl-tRNA Synthetase by Intermediates of the Pathway 405

ENGASSER, J-M. and HISLAND, P., Diffusional Effects on the Heterogeneous Kinetics of Two-substrate Enzymic Reactions . . 427

LIN, S. H., A Modified Model for Predicting the Performance of a Compact Artificial Kidney 441

WARNER, R. R., STRUNK, T. and LECHENE, C., Analysis of Proximal Tubule Salt and Water Transport in Standing Droplets . . 453

BROCKMANN, H. J., GRAFEN, A. and DAWKINS, R., Evolutionary Stable Nesting Strategy in a Digger Wasp 473

LYONS, N. I. and HUTCHESON, K., A Stopping Rule Based on Simpson's Index of Diversity 497

ALVARADO, S., FIGUEROA, R., SEPULVEDA, A., SOTO, M. A. and TOHA, J., Reliability in the Genetic Code 505

ROSS, G. G. and SLADE, N. A., A Predator-Prey Viewpoint of a Single Species Population 513

BARRETT, T. W., Polyelectrolyte-Hysteresis Interpreted as Singularities in the Poisson-Boltsmann Description 523

LETTER TO THE EDITOR

KATZ, R. J., Exploration as a Functional Correlate of Endorphins 525

Index to Volume 77

AINSWORTH, S., The exponential model for a regulatory enzyme: its extension to describe catastrophic changes in function, 27
ALVARDO, S., FIGUEROA, R., SEPULVEDA, A., SOTO, M. A. and TOHA, J., Reliability in the genetic code, 505
AMIDON, G. L., PEARLMAN, R. S. and ANIK, S. T., The solvent contribution to the free energy of protein-ligand interactions, 161
Amino acid sequence homology, 233
Analysis of proximal tubule salt and water transport in standing droplets, 453
Analytic methods for the management of pesticide resistance, 171
ANDERSSON, G., Self-electrophoresis of membrane molecules and chromosomes: unifying hypothesis of cell cycle controls, 1
ANIK, S. T. (see AMIDON, G. L.), 161
Avalanche behaviour in a class of substrate inhibition oscillators, threshold, wave and cell-cell, 317

BARRETT, T. W., Polyelectrolyte-hysteresis interpreted as singularities in the Poisson–Boltsmann description, 523
Base pairs, a reconsideration of the possibility of the specific pairing of, 83
Biological modelling, modulation analysis of forced non-linear oscillators for, 235
Biosynthetic pathways: inhibition of the aminoacyl-tRNA synthetase by intermediates of the pathway, feedforward inhibition in, 405
Botulism toxin, toxicity of: a stoichiometric model for the locus of its extraordinary potency and persistence at the neuromuscular junction, 107
BRITTON, N. F. and MURRAY, J. D., Threshold, wave and cell-cell avalanche behaviour in a class of substrate inhibition oscillators, 317
BROCKMANN, H. J., GRAFEN, A. and DAWKINS, R., Evolutionary stable nesting strategy in a digger wasp, 473
Buffer capacitor concept, flow analysis as a biological system adopting the, 115

Cell cycle, state vector models of the, II. The first three moments of the transit time distribution, 141
Cell proliferation, stability analysis of the two compartment model of, 51
Chromosomes: unifying hypothesis of cell cycle controls, self-electrophoresis of membrane molecules and, 1
COMINS, H. N., Analytic methods for the management of pesticide resistance, 171
Comment on surface modulating assemblies, 383
Computation of the tertiary structure of globular proteins II, 253
COSTANTINO, R. F. (see GINZBURG, L. R.), 307

DAWKINS, R. (see BROCKMANN, H. J.), 473
Diffusional effects of heterogeneous kinetics of two-substrate enzymic reactions, 427
Digger wasp, evolutionary stable nesting strategy in a, 473
DROMASHKO, S. E. and TROITSKY, N. A., A stochastic model of recombination during conjugation in *Escherichia coli* K-12, 37

Endorphins, exploration as a functional correlate (letter), 525
ENGASSER, J-M. and HISLAND, P., Diffusional Effects on the heterogeneous kinetics of two-substrate enzymic reactions, 427

Enzymic reactions, diffusional effects on the heterogeneous kinetics of two-substrate, 427
Escherichia coli K-12, a stochastic model of recombination during conjugation in, 37
Evolution: a thermodynamic and information-theoretical discussion, the generation of complexity in, 349
Evolutionary stable nesting strategy in a digger wasp, 473
Exploration as a functional correlate of endorphins, 525
Exponential model for a regulatory enzyme: its extension to describe catastrophic changes in function, 27

Feedforward inhibition in biosynthetic pathways: inhibition of the aminoacyl-tRNA synthetase by intermediates of the pathway, 405
Feedforward inhibition in biosynthetic pathways: inhibition of the aminoacyl-tRNA synthetase by the penultimate product, 385
Fibroblasts, immortal?, 213
FIGUEROA, R. (see ALVARDO, S.), 505
Flow analysis in a biological system adopting the buffer capacitor concept, 115
Fluid membrane, hydrodynamics of a permeable patch in the, 189
Forces causing osmotic pressure, 47

Generalization of Pileou's index of non-randomness, 19
Generation of complexity in evolution: a thermodynamic and information-theoretical discussion, 349
Genetic code, reliability in the, 505
Genetic adaptation under natural selection, on the rate of, 307
GINZBURG, L. R. and COSTANTINO, R. F., On the rate of genetic adaptation under natural selection, 307
Globular proteins II, on the computation of the tertiary structure of, 253
GOEL, N. S. and YČAS, M., On the computation of the tertiary structure of globular proteins II, 253
GRAFEN, A. (see BROCKMANN, H. J.), 473

HANIG, J. P. and LAMANNA, C., Toxicity of botulinum toxin: a stoichiometric model for the locus of its extraordinary potency and persistence at the neuromuscular junction, 107
HATFIELD, J. L. (see IDSO, S. B.), 217
HISLAND, P. (see ENGASSER, J.-M.), 427
HOLDER, N., Positional information and pattern formation in plant morphogenesis and a mechanism for the involvement of plant hormones, 195
Homology, amino acid sequence (letter), 233
HOPFINGER, A. J. (see KIKUCHI, O.), 129
Hormones, positional information and pattern formation in plant morphogenesis and a mechanism for the involvement of plant, 195
HUTCHESON, K. (see LYONS, N. I.), 497
Hydrodynamics of a permeable patch in the fluid membrane, 189

IDSO, S. B., PINTER, P. J. JR., HATFIELD, J. L., JACKSON, R. D. and REGINATO, R. J., A remote sensing model for the prediction of wheat yields prior to harvest, 217
IMAI, Y., MORI, H., MURAKAMI, M. and YOSHIDA, H., Flow analysis in a biological system adopting the buffer capacitor concept, 115
Immortal fibroblasts?, 213

Jackson, R. D. (see Idso, S. B.), 217
Jacknow, G. (See Savageau, M. A.), 405
Johnson, L. L., Kin selection in finite sibships, 379

Katz, R. J., Exploration as a functional correlate of endorphins, 525
Kibby, M. R., The matrix representation of pharmacokinetic models, 333
Kidney, modified model for predicting the performance of a compact, 441
Kikuchi, O., Hopfinger, A. J. and Klopman, G., A new type of semi-empirical molecular orbital method for large molcules, 129
Kin selection in finite sibships, 379
Klopman, G. (see Kikuchi, O.), 129

Lamanna, C. (see Hanig, J. P.), 107
Lechene, C. (see Warner, R. R.), 453
Lerner, M. R., Immortal fibroblasts?, 213
Lin, S. H., A modified model for predicting the performance of a compact artificial kidney, 441
Linkens, D. A., Modulation analysis of forced non-linear oscillators for biological modelling, 235
Luchnik, A. N., On the mechanism of SOS-repair and prophage induction: relaxation hypothesis, 229
Lyons, N. I. and Hutcheson, K., A stepping rule based on Simpson's index of diversity, 479

Magnetic transducer in birds, 101
Malcolm, A. D. B., Amino acid sequence homology, 233
Matrix representation of pharmacokinetic models, 333
McGavin, S., A reconstruction of the possibility of the specific pairing of base pairs, 83
Mechanism of SOS-repair and prophage induction: relaxation hypothesis, 229
Membrane molecules and chromosomes: unifying hypothesis of cell cycle control, self-electrophoresis of, 1
Mitotic control mechanism in eukaryotic cells: cell-specific mitosis-inhibiting protein excretion hypothesis, 367
Modified model for predicting the performance of a compact artificial kidney, 441
Modulation analysis of forced non-linear oscillators for biological modelling, 235
Mori, H. (see Imai, Y), 115
Molecules, a new type of semi-empirical molecular orbital method for large, 129
Morphogenesis, and a mechanism for the involvement of plant hormones, positional information and pattern formation in plant, 195
Murakami, M. (see Imai, Y.), 115
Murray, J. D. (see Britton, N. F.), 317

Natural selection, on the rate of genetic adaptation under, 307
Neural activity, synaptic transmission in a model for stochastic, 65
New hypothesis on mitotic control mechanism in eukaryotic cells: cell-specific mitosis-inhibiting protein excretion hypothesis, 367
New type of semi-empirical molecular orbital method for large molecules, 129

ONDA, H., A hypothesis on mitotic control mechanism in eukaryotic cells: cell-specific mitosis-inhibiting protein excretion hypothesis, 367
Osmotic pressure, forces causing, 47

PEARLMAN, R. S. (see AMIDON, G. L.), 161
Pesticide resistance, analytic methods for the management of, 171
Pharmacokinetic models, the matrix representation of, 333
Pileou's index of non-randomness, a generalization of, 19
PINTER, P. J., JR. (see IDSO, S. B.), 217
Poisson–Boltsmann description, polyelectrolyte-hysteresis interpreted as singularities in the, 523
Polyelectrolyte-hysteresis interpreted as singularities in the Poisson–Boltsmann description, 523
Positional information and pattern formation in plant morphogenesis and a mechanism for the involvement of plant hormones, 195
Possible magnetic transducer in birds, 101
Predator-prey viewpoint of a single species population, 513
Protein-ligand interaction, in solvent contribution to the free energy of, 161

Rate of genetic adaptation under natural selection, 307
Reconsideration of the possibility of the specific pairing of base pairs, 83
REGINATO, R. J. (see IDSO, S. B.), 217
Regulatory enzyme: its extension to describe catastrophic changes in function, the exponential model for a, 27
Relaxation hypothesis, on the mechanism of SOS-repair and prophage induction (letter), 229
Reliability in the genetic code, 505
Remote sensing model for the prediction of wheat yields prior to harvest, 217
ROSEN, R. A., A comment on surface modulating assemblies, 383
ROSS, G. C. and SLADE, N. A., A predator—prey viewpoint of a single species population, 513
ROTENBERG, M., Stability analysis of the two compartment model of cell proliferation, 51

SAVAGEAU, M. A., Feedforward inhibition in biosynthetic pathways: Inhibition of the aminoacyl-tRNA synthetase by the penultimate product, 385
SAVAGEAU, M. A. and JACKNOW, G., Feedforward inhibition in biosynthetic pathways: inhibition of the aminoacyl-tRNA synthetase by intermediates of the pathway, 405
SCHEIE, P. O., Forces causing osmotic pressure, 47
Self-electrophoresis of membrane molecules and chromosomes: unifying hypothesis of cell cycle controls, 1
SEPULVEDA, A. (see ALVARDO, S.), 505
Sibships, kin selection in finite (letter), 379
Simpson's index of diversity, a stopping rule based on, 497
Single species population, a predator-prey viewpoint of a, 513
SLADE, N. A. (see ROSS, G. G.), 513
Solvent contribution to the free energy of protein-ligand interactions, 161
SOTO, M. A. (see ALVARDO, S.), 505
Stability analysis of the two compartment model of cell proliferation, 51

Standing droplets, analysis of proximal tubule salt and water transport in, 453
State vector models of the cell cycle II: the first three moments of the transit time distribution, 141
STAUFFER, H. B., A generalization of Pileou's index on non-randomness, 19
Stochastic model of recombination during conjugation in *Escherichia coli* K-12, 37
Stopping rule based on Simpson's index of diversity, 497
STRUNK, T. (see WARNER, R. R.), 453
Surface modulating assemblies, a comment on (letter), 383
Synaptic transmission in a model for stochastic neural activity, 65

THAMES, H. D., JR. (see WHITE, A.), 141
Threshold, wave and cell-cell avalanche behaviour in a class of substrate inhibition oscillators, 317
TOHA, J. (see ALVARDO, S.), 505
Toxicity of botulinum toxin: a stoichiometric model for the locas of its extraordinary potency and persistence at the neuromuscular junction, 107
TROISKY, N. A. (see DROMASHKO, S. E.), 37
TUCKWELL, H. C., Synaptic transmission in a model for stochastic neural activity, 65

WARNER, R. R., STRUNK, T. and LECHENE, C., Analysis of proximal tubule salt and water transport in standing droplets, 453
Wheat yields prior to harvest, a remote sensing model for the prediction of, 217
WHITE, A. and THAMES, H. D., JR., State vector models of the cell cycle II: The first three moments of the transit time distribution, 141
WICKEN, J. S., The generation of complexity in evolution: a thermodynamic and information-theoretical discussion, 349
WIEGEL, F. W., Hydrodynamics of a permeable patch in the fluid membrane, 189

YČAS, M. (see GOEL, N. S.), 253
YORKE, E. D., A possible magnetic transducer in birds, 101
YOSHIDA, H. (see IMAI, Y.), 115